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Abstract

Subterraneous Disposal of Radioactive Waste in Cavities made in Salt Deposits

by

G. Richter-Bernburg
Bundesanstalt für Bodenforschung Hannover

The disposal of radioactive waste at the surface or just below surface includes the possibility of accidental or violent destruction of the stock and of dispersion of the dangerous material. Therefore, the disposal deep in the earth will have preference. Because it must be excluded that parts of radioactive matter enters the biological cycle the waste is to be protected against circulating groundwater. In most rocks - even by joints and fissures in "impermeable" rocks - groundwater is moving. No circulation takes place

1) in very great depths where groundwater - almost fossil water - stagnates also in permeable formations,

2) in few places of high mountains where a fairly dense type and a favourable position of impermeable rock can exclude any communication with the groundwater table,

3) in rocksalt (halite as rock).

Concerning liquids and gases halite is in general the most impermeable of all rocks. This fact has been proved, at many places of the world, by groundwater-, oil- and natural gas-exploration as well as by mining operations.

In Germany, experience about the practical behaviour of salt rocks has been gathered in numerous salt and potash mines during the last 80 years. For examination of the physical properties of halite, different experiments have been made in USA by the Atomic Energy Commission in Oak Ridge/Ten. in laboratories as well as in mines in Kansas. After discussions and mutual visits, German and American geologists (Bundesanstalt für Bodenforschung, Hannover, and Oak Ridge National Laboratory) came to the result that cavities in rock salt are the ideal jails for radioactive waste under any conditions. They are safe in use and cheap in arrangement.

Some provisions have to be made from the geological point of view. The halite should have a fairly considerable thickness (possibly more than 50 m) and should be pure and not have intercalations of other rocks, such as anhydrite a.o. Table-like deposits of halite which are lying almost horizontal are generally less qualified than salt accumulations in domes or diapirs. (The reasons will be explained.) The depth in which the cavities for disposal will be installed should be about 500 m or more because the natural salt flow there prevents the origin of any fissures and keeps the salt impermeable.

Salt formations where these conditions are realized are known in many places. Concerning Europe, in Germany, in the Netherlands, in Denmark, in England, also in France and Switzerland there are deposits suitable for the installation of disposal cavities. (The locations of the most suitable salt-occurrences will be reported in detail.)

To hole cavities for waste disposal two different ways can be taken. There is the possibility to use the galleries and other rooms of salt or potash mines, which were abandoned. (Details in the paper.) The operating expenses are extremely low. By drilling wells from the surface into the salt and by excavating these wells by solution of salt, rooms of about 5000 up to 200 000 m^3 can easily be obtained. The costs per m^3 are less than the expenses of a stock at the surface.